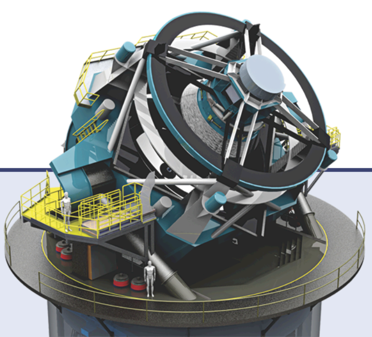
Photometric redshifts DESC tasks



Task list

- High priority (H)
  - H-1: Calibration strategies
  - H-2: Produce realistic tools to test photo-z strategies and impact on science requirements
  - H-3: Testing cross-correlation techniques

- Longer-term (LT)
  - LT-1: Optimal methods of storing and using p(z) information

H-1: Calibration strategies

- **Motivation**: Calibration of photo-z algorithms requires a “truth” set of secure redshifts for a representative subsample of galaxies. Incompleteness in training data will lead to biases in LSST redshift estimates, which will propagate directly into the dark energy constraints if not accounted for otherwise (see also Task H-3). Obtaining training sets must begin soon due to the large investments of telescope time required.
- **Activities**: We will develop a detailed plan for targeted spectroscopic observations sufficient to meet LSST calibration/training set requirements, and reach out to potential partners. We will also explore obtaining very deep multi-wavelength imaging that enables very accurate photo-z estimates of faint galaxies for which spectroscopic measurements are difficult. We will investigate synergies with upcoming large space based missions (EUCLID, WFIRST) that could be mutually beneficial
- **Deliverables**: A comprehensive photo-z calibration plan; the first proposals to fulfill that plan; results from negotiations with the EUCLID/ WFIRST teams. See also Task H-2.

H-2: Produce realistic tools to test photo-z strategies and impact on science requirements

- **Motivation**: Lacking LSST-scale data sets, we must rely on simulations to predict photo-z performance, but those currently available have insufficient fidelity. We need simulations with realistic template and training set incompleteness to accurately set LSST science requirements (Ivezić & the LSST Science Collaboration 2011) that are driven by photo-z errors, as well as to optimize methods for rejecting objects with problematic photo-z determinations.
- **Activities**: We will develop a detailed framework for simulating LSST photo-z performance, which can be used to test the impact of template or training set incompleteness. We will explore methods for identifying and removing objects with problematic photo-z's, investigating tradeoffs between photo-z performance and sample size, and investigate approaches that optimize dark energy errors.
- **Deliverables**: Realistic simulation code and outputs; improved algorithms to identify problematic areas of parameter space; updated Science Requirements.

H-3: Testing cross correlation techniques

- **Motivation**: Cross-correlation methods can provide accurate photo-z calibrations while avoiding the problem of incompleteness in deep spectroscopic samples, but tests to date have not been in the high-precision regime required for LSST, making this a potential risk that must be explored.
- **Activities**: We will test this method by dividing the BOSS spectroscopic sample into subsets, differing in observed color or magnitude (and hence in z distribution and LSS bias), and attempting to reconstruct the true z distribution of one sample using only position information and redshifts from the other sample. We will use both this dataset and realistically-complex mock catalogs to explore methods of dealing with bias evolution and to test the impact of correlations between bias and errors.
- **Deliverables**: Comparison of actual to predicted reconstruction errors; assessment of residual reconstruction errors from bias evolution and from covariance of photo-z errors and galaxy properties.

LT-1: Optimal methods of storing and using p(z) information

- **Motivation**: Dark energy inference will be more accurate if we use full redshift PDF information (p(z)) for each object; exploration of optimal methods to determine and store this are needed soon as this can affect LSST database design. Significant progress is expected from Stage III surveys.
- **Activities**: We will focus on activities that need to happen soon as they impact data management requirements, and will not occur as part of Stage III; e.g., determining the most compact representation of the redshift PDF for an object that yields bias-free results, whether to store multiple p(z) estimates from different algorithms, and how to combine different p(z) estimates.
- **Deliverables**: Storage requirements for LSST data management.